UNIV. OF
TORONTO
LIBRARY

P78-8720-(84)

University of Toronto Engineering Society

I

APPLIED SCIENCE

111

INCORPORATED WITH

TRANSACTIONS *of the* UNIVERSITY *of* TORONTO ENGINEERING SOCIETY

$1.85-

Vol. VIII - New Series

May, 1913 to April, 1914

133514
24/7/14

PUBLISHED BY
THE UNIVERSITY OF TORONTO ENGINEERING SOCIETY
ENGINEERING BUILDING
UNIVERSITY OF TORONTO, CANADA

Applied Science

INCORPORATED WITH

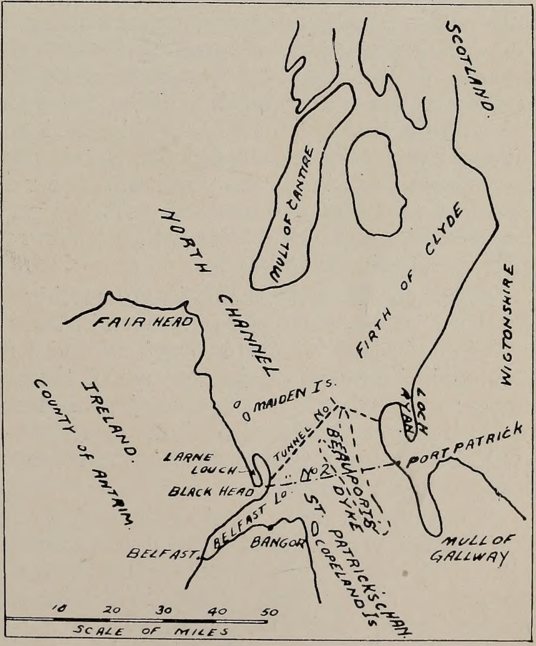
TRANSACTIONS OF THE UNIVERSITY OF TORONTO
ENGINEERING SOCIETY

Old Series Vol. 26 TORONTO, NOV. 1913 New Series Vol. VIII. No. 7

RAILWAY ACROSS IRISH CHANNEL

Proposed by H. G. Tyrrell, C.E.

We find recorded in history many instances which demanded the most careful consideration of the shrewdest politicians and the most earnest attention of the keenest statesmen to maintain harmony among various nations or even among the different components of the one nation. The worthy efforts of these statesmen have rightly been handed down to succeeding generations as playing an important role in the history of the nation. Unfortunately history does not give prominence to the constructor or industrial engineer and the part that his work has played in the upbuilding of the different countries and in fusing together their various parts. The building of roads and the construction of transportation lines is essential to commercial greatness. Realizing the need of road development, the Romans introduced their policy of highway extension as their best and surest means of developing and uniting their great dominion. In Canada, the West was never in sympathy with the



East, nor the East with the West until the construction of highways and other channels of commerce opened up an inter-communication which made their interests inter-dependent. Africa and Australia have profited in a similar manner, and much still remains to be done in these two countries. Probably the best example of a country suffering internal strife due to a lack of industrial enterprise and construction work is India. The various tribes have not sufficient intercourse to feel that they have any interests in common. Quarrels between nations have, no doubt, often been averted as a result of their commercial relations. The various means of transportation not only serve to establish and maintain unity among provinces and states, but also are the very foundation of commercial greatness.

The Emerald Isle, unfortunately, is separated from England and Scotland by the Irish Channel, and so does not enjoy the commercial prosperity which it otherwise would, trade being materially impeded by the water barrier, which, though easily navigated, requires several hours to cross it. Mr. H. G. Tyrrell, consulting engineer, of Chicago, proposes to connect Ireland and England by means of a railway across the channel. Such a railway would shorten the time for crossing the Atlantic from America by a day or more, and develop terminal ports on the Irish coast, thereby enormously increasing the local commerce, and offering greater chances for employment and extended opportunities to its people. The Irish railways would, in fact, become the through routes from America to India and the far East, instead of being subordinated, as they are now, for local business from Liverpool and Glasgow. It is also pointed out by Mr. Tyrrell that, if a similar line crossed the channel from England to France, making through rail connection from Great Britain to the continent, the railway traffic of Ireland would be still further increased. At the present time ocean traffic from America to Ireland frequently goes first to Liverpool and thence back to Dublin or Belfast.

A grave difficulty arises in connecting the railway systems of the two islands due to the difference in their gauge, which is standard width 4 ft. 8½ inches in England and 5 feet 3 inches in Ireland. This could be overcome in any one of three ways: (1) transferring cargoes at the border; (2) changing all tracks to standard gauge, or (3) laying a third rail on both systems. Any of these methods would be costly, but a change would necessarily follow the construction of a channel road.

The shortest route would be across the North Channel between Tor Point in Antrim to the Mull of Cantire, a distance of fourteen miles. This would lead too far north and would necessitate the crossing of other difficult waters in Scotland, thus rendering it quite impracticable. A better location further south is from Blackhead, northeast of Belfast, to Port Patrick, a distance of twenty-three miles. An unfortunate feature of this latter course is the presence of a depression known as Beaufort's Dyke, the bottom of which is 200 to 300 feet lower than the other parts of the sea, which has a normal depth of 400 to 500 feet.

The author of the scheme suggests four possible methods of establishing a railway across the channel: (1) a continuous embankment or causeway; (2) a submarine tunnel; (3) a submerged floating tube or viaduct, and (4) a bridge.

In an article in the October issue of "The Popular Science Monthly," Mr. Tyrrell estimates that a continuous embankment across the channel would cost $100,000,000 or possibly more. It could be used for a double track line of railway and for the development of electric power from the strong north current, which it is pointed out, would produce fifty times as much power as the whole of the Niagara Falls. Such obstruction of the natural currents would, however, give rise to a very serious objection by lowering the water in the harbors of Glasgow, Liverpool, Belfast and Dublin, and it is very doubtful if such a causeway would be practicable.

Again, a high level bridge would necessarily be carried on floating piers and would cost such a tremendous sum as would be prohibitive.

The cost of a submarine tunnel would be much less than that of either of the above proposals, and after completion would be much more satisfactory. The deep water of Beaufort's Dyke could be avoided by bending the tunnel to the north around the depression, thereby increasing the tunnel length under water to twenty-five miles, with a total length of thirty-five miles, including the approaches. The possibility of carrying on such a work would depend entirely upon finding impervious strata, the presence of which could be determined by boring. The overhead thickness of rock in the Mersey Tunnel is 30 feet, and in the Severn Tunnel is 40 feet. Tunneling with compressed air to exclude water is possible at depths not exceeding about 150 feet below the surface of the water for then the atmospheric pressure reaches about 75 pounds per square inch, and pressures and depths not exceeding half these amounts are usually enough for effective work. It is estimated that the tunnel would cost from $35,000,000 to $50,000,000, depending upon its location and other conditions, and would require ten or twelve years for construction.

Floating tubes might be used submerged and anchored far enough beneath the surface of the water to allow ships to pass over them. If the tubes were to float on the surface, openings would necessarily be left for water travel, which might be accomplished by depressing occasional sections four or five miles apart, leaving openings of 1,000 feet or more, the presence of which openings could be indicated by signals. Submerged tubes would be in comparatively quiet water while the floating ones would be subjected to the effects of wind and waves. The chief objection to these tubes is their deterioration by rust and the difficulty of repairing them under water.

If lying on the surface the tubes would be proportioned like ships, to receive varying support, and to bridge the waves from one crest to another. The weight of the submerged tubes should be as nearly equal to the weight of water displaced as possible so that there would not be too much pull on the anchors when empty or too much pull on the surface floats when loaded. The tubes would be made in convenient lengths of 200 feet to 400 feet with their ends temporarily closed, and floated out into position and sunk to the desired depth and connected. The temporary dams should be built three or four feet back from the ends, thus leaving space for the divers while putting the sections together. It is estimated by the author of the scheme that the cost of a submerged viaduct of this kind would be from $25,000,000 to $30,000,000, and it is no doubt the type of channel railway which would be most successfully put into operation.

If such a railway were built we believe that it would do much to dispel the present discontent in Ireland and would enable her to participate to a greater extent in the general welfare of Great Britain.

Mr. Tyrrell is a graduate of the "School," belonging to class '86. His biography appeared in July issue of APPLIED SCIENCE this year, so we do not feel it necessary to mention here the distinction which he has attained in engineering, not only in practice, but as a writer of engineering books.

WHAT OUR GRADUATES ARE DOING

R. L. Hearn, B.A., Sc., '13, is with the Dominion Bridge Co. at Lachine, P.Q.

M. B. Watson, B.A., Sc., '10, formerly with the Toronto Power Co., is now assistant engineer with the Public Roads and Highways Commission of Ontario.

A. J. Dates, B.A., Sc., '13, is on the designing staff of Harkness & Oxley, consulting engineers, Toronto.

J. S. Laing, B.A., Sc., '13, is with H. W. Tate, Ontario land surveyor, Toronto, Ont.

W. T. Curtis, B.A., Sc., '13, is with the Buffalo Mines, Cobalt, Ont., in charge of the cyaniding department.

D. A. Mutch, B.A., Sc., '13, is shift boss with the Dome Mines Company Limited, at Cobalt, Ont.

W. V. Oke, B.A. Sc. '13, is sales engineer for the Central Steel and Wire Co., 220 King street west, Toronto, Ont.

L. E. Jones, B.A., '11, and C. W. Cornell, '11, are engaged in a general contracting business at New Westminster, B.C., under the name of the Jones, Cornell Construction Co., Limited, Engineers and Contractors. Their office address is 407-408 Westminster Trust Building, New Westminster, B.C.

F. W. Beatty, B.A. Sc., '13, is on D. L. S. work in the Westminster District, B.C. Mail addressed to 1164 Pacific street, Vancouver, B.C., will be forwarded.

GOLD

Wm. B. McPherson, B.A.Sc.

The development of the Canadian mineral industry has been marvelously rapid, but more interesting are its possibilities.

It is all but impossible to realize the magnificent future of this vast Dominion with its area greater than that of the United States and about equal to that of the whole of Europe.

The great "V" shaped area of pre-Cambrian rock which surrounds Hudson Bay extending from Laborador almost to the mouth of the Mackenzie River has, where examined, been found to contain exceedingly valuable, and in many cases, unique mineral deposits. Canada's future will probably depend more upon her mineral production than upon any other of her natural resources. At present, with a small portion of the Dominion prospected the total mineral production for 1912 was equal to $18.50 per head of the whole population of this vast country.

Of all our minerals, gold has a peculiar place because its value is unchangeable. When gold is mined the value is obtained immediately. With other minerals there is the market to be considered. It is doubtful if the Dominion, as we now understand it, would have come into being with British Columbia at the western side, but for the finding of gold, no one would have thought of building a railroad through that wilderness for had there not been a powerful magnet at the end The Klondike would have remained the unknown Arctic region had but for the discovery of gold. The gold from the mine is not subject to ordinary supply and demand, but may be taken to the Bank of England, the Canadian Mint, or to the United States treasury and money received for it at a fixed rate.

Gold with its magnetic influence is usually the first sought mineral in a new country and in Canada as elsewhere, we find the quest of gold one of the earliest of our industries.

In Nova Scotia, in Ontario, and in British Columbia mining may be said to have commenced in earnest at nearly the same time, about 1860, largely due to the influence of the discoveries in California some few years before.

About the time Simon Fraser, in the first years of the nineteenth century, crossed the Rockies to the head of the river now bearing his name, the early settlers of Vancouver Island had begun to realize the wealth of British Columbia and had sailed away from Moresby Island, one of the Queen Charlottes, with a rich cargo of gold ore, which paid them well for their enterprise, but for some reason they did not repeat their venture. Practically, therefore, the first mineral development is that due to the Fraser River gold rush in 1858 and succeeding years, when the Cariboo and Quesnel districts were discovered, followed in 1874 by the discovery of gold in Cassiar. Most of the provinces have had discoveries since those days.

Canada's best year of production was 1900 when the value was $27,908,153. In 1907 this decreased to $8,382,780, but rose to $12,648,794 in 1912.

Ontario had never reached the $500,000 mark before 1912 when, owing to the discoveries at Porcupine and adjacent districts, $2,114,086 was produced. This present year will eclipse all records.

The world's annual production has shown a remarkable change since 1902, when it was placed at $298,812,493. The year 1912 saw the enormous total of $469,618,083 recovered. We are vitally interested in the modes of consumption of gold, which including its use, are of equal importance with those of its production and classifying roughly it comes under three heads:

(1) Its use as merchandise.
(2) Its use as money.
(3) The "drain" to the East.

With regard to its use as merchandise, it may be said with some confidence that the demand for personal use tends, after society has made some progress, to decline in strength. The desire for adornment is not a keen one with most civilized persons; and so far as it exists, is gratified in other ways than by using gold. For purposes of manufacture its use is increasing.

The use of gold as money is the most important and is evidently connected with the need for metallic currency; and this again depends on the level of prices and the monetary organization, including in the latter the banking system.

The drain to the East, which commenced in the middle ages when luxuries such as silk and spices, were imported, and gold and silver were sent from Europe to pay for them, has increased. India takes, year by year a considerable amount of gold bars which may in the future have a monetary use, but up to the present appear to be hoarded or used for ornament.

With the complete reconstruction of Eastern currencies that now seems probable, there may come a decided change in the character of the demand. The tendency to fix prices on a customary basis is bound to yield to the pressure of competition. The inevitable result will be to make the price level alter with each influx of money, and thus to limit the demand for bullion through the action of exchanges.

One of the technical features of the production of precious metals should be noted in consequence of its economic effect. Gold has more frequently been found near the surface; silver is usually obtained by deep mining. It follows that the amount of the former metal produced depends more on accidental circumstances, in contrast to that of silver, which is affected by the standard of mining skill. The mines of Nevada were exceptional in their possessing both metals in nearly equal value.

The gold mines of South Africa have come to be worked at deep levels and, therefore, are technically in the same class as silver ones. In fact, there is a pronounced tendency all the world over towards the systems of capitalistic working.

The first point to which attention may be directed is the field over which production extends. At one time or other this metal and also silver have been found in every continent.

Asia Minor in earliest times possessed its gold fields, or rather auriferous sands. Ceylon also undoubtedly contained gold mines. China and India both produced silver to a considerable extent. Egyptian remains show that gold was commonly known in that country, probably procured from Arabia and Abyssinia. On the opposite side of Africa, too, the name of Gold Coast shows that that metal was thence exported. The mines of Laurium in Attica were a source of supply to the Athenians and were worked as a state monopoly. At an earlier date the Babylonian and Assyrian empires had each accumulated large stores of gold, and the Phoenician importations of gold from the Red Sea coasts (Ophic) are known from Scripture. The Persian kings from the time of Darius levied tribute on all their provinces in gold from India, in silver from the remaining districts, the larger part of which was stored up in the royal treasuries. This tendency of despotic rulers to accumulate treasure had all through ancient history important effects on the economic structure of society.

At present it is quite natural to assume that the materials of money are distributed by means of international trade and tend to keep at an equal level all the world over—an assumption which is in general well grounded, though an important exception exists.

Ancient history presents a widely different set of forces in operation. Gold and silver were produced by slaves under the pressure of fear, and were drawn towards the ruling parts of the great empires; in a word, war, not commerce, was the distributing agency. From this condition of affairs it is easy to see that, whatever may be the reason for assigning to cost of production a patent influence over the value of money in modern times (and grounds have been already advanced for the belief that its influence has been exaggerated) no such reasons then existed.

The production of the precious metals was carried on in similar manner to the great buildings and other works of those periods, on non-economic grounds, and therefore produced quite different effects. The whole history of the Persian monarchy to its overthrow by Alexander (330 B.C.) shows that the hoarded mass of the precious metals continued constantly to increase. On the capture of Persepolis by the Grecian army an enormous treasure was found there, some estimates putting it as high as $138,000,000 of gold.

All the temples, too, were receptacles of this precious metal, so that the stock accumulated at about 300 B.C. must have been very great. The only causes which tended to diminish the store were the losses arising from wars, when the various treasuries were liable to be plundered and their contents dispersed. There was, therefore, a more unequal distribution of the material of money than at present. The growth of Roman dominion led to important results, since under their rule the Spanish mines were developed and became a leading source of supply. The great masses of treasure set towards Rome, so that it became the monetary centre of the world. The overthrow of the republican government and the peace which followed also affected the conditions of production.

The inefficiency of the Roman administration made it advantageous to let out the mines to farmers who worked them in a wasteful and improvident manner, while the supply of slaves was reduced, thus depriving the lessees of their principal agency for carrying on production. The result was a continuous decline in the store of money. The succeeding centuries exhibit a steady decline, though it is, of course impossible to attach any value to even the most carefully guarded numerical estimates.

The phenomenon which has since so often attracted notice—the drain of precious metals to the east—began at this time and was a subject of complaint by the Roman writers, while the stock of gold and silver being thrown into general circulation suffered from abrasion, and was more likely to be lost than when stored up in the royal treasure houses and temples. These causes tended to depress the scale of prices, while the barbarian invasions produced a strong effect on the supply by drawing off the mining population and damaging the various erections used for working the mines. The conjectural estimate is that about A.D. 800 the total supply had been reduced to $165,000,000 or about one-eleventh of what it had been at the death of Augustus (A.D. 14). A new period in the history of gold and silver production may be fixed at this date. The Moors, now firmly established in Spain, began to reopen the mines in that country which had been allowed to fall in disuse. Other European mines also were opened, notably those of Saxony and the Harz Mountains, as well as the Austrian mines—the chief medieval sources of supply.

The international system of currency based upon the pound of silver as a unit, which was introduced by Charlemagne, must have tended to economize the wear of the metals. We may, therefore, conclude that from this date (A.D. 800) the supply was sufficient to counteract the loss by wear and exportation, and accordingly regard the metallic supply as fixed in amount until the next change in the conditions of production, which was the discovery of America. Though 1492 is the date of the first landing, yet for some time no important additions were made to the supply of money. The full effect on prices was produced by 1640, and the increased amount of money was from that time counterbalanced by the wider extension of trade. At the commencement of the nineteenth century the annual production of gold had been estimated as being from $12,500,000 to $15,000,000.

The year 1809 seems to mark the epoch in the production; since the outbreak of the results in various Spanish dependencies in South America tended to check the usual supply from these countries, and a marked increase in the value of money was the consequence. During the period 1809-1849 the value of gold rose to about two and a half times its former level notwithstanding fresh discoveries in Asiatic Russia which became considerable from 1823. The annual yield in 1849 was estimated at $40,000,000.

The next important date is the year 1848, when the Californian mines were opened, while in 1851 the Australian discoveries took place. By these events an enormous mass of gold was added to the world's supply.

The most careful estimates fix the addition during the years 1851-1871 at $2,500,000,000, or an amount nearly equal to the former stock in existence. The problems raised by this production have received careful study. The main features have been briefly summed up by one authority under five headings.

(1) The additional supply was almost entirely of gold tending to produce a distinction between the two principal monetary metals and an alteration in the currency of bimetallic countries. Under this influence France became a gold using country.

(2) The contemporaneous development of the continental railway systems and the partial adoption of free trade with the consequent facilities for freer circulation of commodities, led to the course of distribution being different from that of the sixteenth century. The more backward districts were the principal gainers and a more general equalization of prices combined with a slight elevation in value was the outcome.

(3) The increased supply of gold rendered a general currency reform possible, and made use of a gold monometallic standard appear feasible. The movements for currency reform all arose after these discoveries.

(4) The change in the value of money, which may for the period 1849-1869 be fixed at 20% enabled a general increase of wages to be carried out, thus improving the conditions of the classes living on manual labor. It may be added that the difficulty of tracing the effects of this great addition to the money stock is a most striking proof of the complexity of modern economic development.

(5) The last point to be noticed is the very small influence exercised on the value of silver by the new gold. The gold price of silver in London rose only from 59¾d. per oz. to 62½d. per oz.—i.e. between 4 and 5%. Hardly had the gold discoveries of 1848-1851 ceased to produce a decided effect when new silver mines of unusual fertility came into working.

During the period immediately succeeding the gold discoveries the production of silver remained at an annual amount of from $40,000,000, to $45,000,000. This amount suddenly, about 1870, increased to $75,000,000 and remained at that amount for the next five years. This increased supply was accompanied by a marked depreciation in the gold price of silver, though the price of commodities in countries having a silver standard did not rise. Before any monetary adjustment took place the situation changed in consequence of a renewal of the Australian gold production, soon followed by the great gold discoveries in South Africa. The annual output of gold, which had fallen below $100,000,000 in 1884 rose rapidly to $300,000,000, and in 1908 reached the prodigious figures of over $400,000,000 with prospects of a larger yield in the future. By this change the difficulties that had led to the agitations for "free silver" in the United States, and for "international bimetallism" in Europe and in India were removed, showing the close connection between the production of the precious metals and the economic, especially the monetary policy of all periods.

Credit, in general, depends on confidence, and confidence first, on the belief in the soundness of the banking world, and secondly, in the belief that every creditor of a bank can get gold if he is entitled to it. If estimates were never wrong and nature never capricious, there would not be the need for gold. But as it is, gold is required because in addition to being currency it is also a form of wealth. While a bank note and cheque are worth nothing by themselves and lose in a crisis the intrinsic value which confidence gives them, gold has an intrinsic value of its own. If a depositor has his money in gold, he may be indifferent to the fate of his bank, because the value of the gold is wholly independent of credit.

Gold is the only universally acceptable form of currency. Not only is it the indispensable foundation on which to build a banking system, but is the sole means for settling the balance of indebtedness between one nation and another. When their respective debts have been set off against one another the balance must be settled in gold. Every civilized country, therefore, with a developed banking system, must have a big reserve of gold. Gold must be always available somewhere, and it is always available, but only from one place in the world, London alone among the great financial centres, has undertaken the task of meeting every legitmate demand in gold at all times and to any amounts. If Germany has to pay gold to Turkey for a loan newly granted, she gets it from London; if New York wants gold, she gets it from London; if the Argentine or Egypt or India have had a good harvest and want gold, they get it from London.

Since 1895 the world's gold has increased by $5,000,000,000. A great portion of this huge sum has passed through London, because London is a free market. Gold comes there freely, because it can be freely taken away again, a matter of intense importance to British credit. Since 1895, while the United States have absorbed about $1,000,000,000, and Russia and other countries very large amounts, London, the great gold mart of the world, has retained only about $150,000,000.

Gold has no country; it goes where people are willing to pay most for it. Although gold is the standard, other things are increasing in value; that is, more is paid for a given quantity of anything now than formerly. This is caused by the increasing gold production. The gold of the world is increasing, and instead of it showing itself in a depression in its own value, it shows itself in the added price of everything we buy. Gold is falling in value in reality, or other things are rising in value. The increase in gold has been responsible for the wonderfully good times of the last few years; the standard everywhere is gold and there seems little doubt that Canada will ultimately develop rich deposits take her place prominently with the world's leading gold producers.

Gold Production of Canada

	British Colm.	Yukon	Alta.	Nova Scotia	Ontario	Que.	Totals
1907	4,883,020	3,150,000	675	282,686	66,399	...	8,382,780
1908	5,929,880	3,600,000	1,037	244,799	66,389	...	9,842,105
1909	5,174,579	3,960,000	525	210,711	32,425	3,990	9,382,230
1910	5,403,318	4,570,362	1,850	163,891	63,849	2,565	10,205,835
1911	4,989,524	4,580,000	200	142,000	37,929	12,443	9,762,096
1912	....	....	...	......	2,114,086	.....	12,762,880

A DUST TREATING EQUIPMENT

The manufacture of Portland cement gives rise to a large amount of fine dust which is undoubtedly injurious to those who must work in the air laden with the fine particles. The Western Precipitation Company, of Los Angeles, California, has experimented extensively for some years in an attempt to determine some type of apparatus which would do away with the dust nuisance. They have installed a Cottrell Electrical Precipitation Process at the plant of the Riverside Portland Cement Co., Crestmore, to control the nuisance caused by cement dust arising from the rotary kilns in the manufacture of the Portland cement. Although the final improvements have not been applied to the whole dust catching plant, yet results recently obtained on part of the apparatus show such remarkable efficiency that it seems highly probable that the great plant will soon have a practically clean skyline.

After two years of experimenting and the expenditure of several thousand dollars to determine the type of apparatus best suited to their needs, a treater was designed which is giving excellent results. The company's engineers decided it advisable to place the dust treating equipment on top of the existing stacks. Each kiln has a separate double treater, entirely independent of the others, so that should it become desirable to shut down one-half of any individual treater, the whole volume of gas and dust can be passed through the other half, or, any kiln and its treater may be shut down without affecting the rest of the treating system. Each half-treater is rectangular in shape, 14 feet high by 12 feet wide by 35 feet long. The treater boxes contain a system of discharge and collecting electrodes, between which flows a constant discharge of approximately 60,000 volts of uni-directional electrical current. To obtain this high voltage it is first necessary to step up the alternating current entering the electrical apparatus at 220 volts, to 60,000 volts, and then by means of a special rectifying machine, change this 60,000 volts of alternating current to 60,000 volts of direct current. All the high tension wires are enclosed in screen cages to ensure the safety of those handling this high tension current.

There has not been a single accident of any kind due to careless handling

The dust laden gases enter the Cottrell treater without previous cooling, or at 825 degrees Fahrenheit and at nearly 4,000 feet per minute velocity. This means that it takes about three seconds for a unit of gas to pass through a treater, and during this three seconds the dust is precipitated by electrical means and left behind, the gases escaping through an outlet stack freed from all solid particles.

Once each hour the treaters are cleaned by mechanical means, the collecting dust falling into hoppers is weighed on automatic scales and conveyed to bins where it is available for shipment as fertilizer or other uses.

The process removes, as before stated, all the solid dust particles, the only color showing at the outlet stacks being that of the smoke from the burning oil and minute quantities of potash which leave the stacks as gases, condensing after they strike the colder outside air. This potash, largely soluble in water, is of the same chemical composition as the high priced fertilizing potash purchased by all orange growers.

Measurements show that each kiln stack delivers to its corresponding treater over 5,000,000 cubic feet of gas per hour, carrying about 700 pounds of dust, or a total of over 90 tons of dust per 24 hours for the whole plant. The 90 tons of dust sold as fertilizer or asphalt filler brings in a revenue more than sufficient to pay for the entire operating costs of the Cottrell treaters, including electrical energy, labor, depreciation and interest on the investment.

To bring this process to its present high degree of efficiency, the Riverside Portland Cement Company has expended many thousands of dollars in experimental work, but it is safe to say these results would not have been attained but for the untiring efforts of the Western Precipitation Company, which staked its reputation on the outcome of the work.

C. F. Publow, B.A.Sc., '08, is on the designing staff at the City Hall, Toronto.

C. R. Avery, B.A.Sc., '13, N. F. Parkinson, B.A.Sc., '13, C. S. Robertson, B.A.Sc., '13, and A. V. DeLaporte, B.A.Sc., '11, have been with the International Joint Commission investigating the pollution of the waters of the Great Lakes. They are now in the Ontario Board of Health experiment plant on Clifford St., Toronto.

F. D. Wilson, B.A.Sc., '08, formerly with the Canada Foundry Co., is now on the staff of the Standard Steel Construction Co. Ltd. at Welland, Ont.

W. P. Murray, B.A.Sc. '08, is engineer on erection for the Dominion Bridge Co. at Lachine Locks, Que. His address is 63 Riverside Drive, Lachine Locks.

Alex. H. Smith, '00, a member of the consulting mining engineering firm, Carter & Smith, has been appointed manager of the Teck-Hughes mine at Kirkland Lake, Ont.

RESEARCH SCHOLARSHIPS

Since the last announcement of the Engineering Alumni Association concerning its research scholarship movement, a good deal of advance has been made both in the matter of actual research work and in the maintenance of funds. It will be remembered that last year two scholarships were maintained, viz., Mr. M. R. Shaw, B.A.Sc., '09, who spent the session in the laboratories of the Department of Applied Chemistry, investigating the value of certain oils from jack pine and pinion woods as a substitute for linseed oil in paints. Mr. Shaw, as announced, completed his work in May of 1913, and presented a monograph covering in detail the main features of his study. (See Applied Science, May, 1913). The utilitarian value of these substitutes was not found to be of any commercial importance.

At the same time, Mr. W. P. Dobson, B.A.Sc., 1910, was investigating the disturbing effects produced by switching on and off large amounts of power on transmission lines of high voltages. Mr. Dobson is still engaged in this work. The Association has seen fit, with the approval of the University Committee on Scholarships, to extend his scholarship into the third term.

As announced at the annual meeting of the Association last Spring, the winter months were spent almost entirely in perfecting the oscillograph by making automatic adjustments for measuring purposes. This phase of the work was given a great deal of attention by Prof. Rosebrugh, Prof. Price and Mr. Dobson. It was obligative that the apparatus be very carefully adjusted, as readers will remember from an account of the work as outlined at the annual meeting.

In May, with the approval of the University Committee, the the executive of the Alumni Association extended Mr. Dobson's scholarship for a second six months, or for a sufficient portion of this period to permit the investigative work to be carried out. In fact, the spring was practically over before Prof. Price and Mr. Dobson had the oscillograph and its various attachments in the perfect condition desired. Up till that time, then, no active research work had been accomplished.

Mr. Dobson's first observations were made on the various lines of the distribution system of the Toronto Hydro-Electric System. The oscillograph was set up at the various sub-stations, and readings of every possible character obtained. Owing to the frequent disturbances produced by the failure of certain insulators on the transmission lines in the early summer months, it was not possible to do any experimental work of any kind, but to hold the instrument in readiness to obtain readings when any switching was done, or when infrequent occurrences, such as lighting surges, etc., took place.

Having acquired all the information desired from the various branches of the distribution system, Mr. Dobson recently transferred his measuring equipment to Dundas, Ontario, and set up the apparatus to observe readings on the high tension power transmission lines of the Hydro-Electric Power Commission. As may be expected this is a very important part of the investigation and exceeding care is taken to produce accurate and authoritative results.

Arrangements have been completed with the Toronto Power Company whereby Mr. Dobson will be able to experiment for a short time on the new transmission line, which will shortly be thrown into commission by that company, and it is felt that a great deal of benefit will be derived from this work on the new line.

A month ago, the Executive Committee took up the question of Mr. Dobson's scholarship and decided to offer to extend it for a third term, pro rata. This has been accepted by Mr. Dobson, and the Association feels quite fortunate in having him continue the work.

It must be remembered that when all readings are taken, the investigation is by no means at an end, for then begins a long series of mathematical complications whereby the important features of the research will be derived and put into shape to be of service.

It might be stated also, that so far as is known at the present time, Mr. Dobson has gone into the study in a much more comprehensive manner, and with more suitable equipment than has any other experimenter in connection with this phase of the science. No mention should be made of the scholarship movement without expressing appreciation of the conscientious and undivided attention which Mr. Dobson himself has devoted to his work. The acquiring of such results entailed a considerable amount of vigilance constant, almost night and day. Professor Rosebrugh and Prof. Price have been of untold assistance to him in his work, and a great deal of credit is due them for the perfect working of the apparatus.

Nor should the fact be overlooked that both the Hydro-Electric System and the Hydro-Electric Power Commission have been most obliging and attentive in all phases of the work, and the appreciative manner in which Mr. Gaby, Chief Engineer of the Hydro-Electric Power Commission, has attended to the requests that have reached him in connection with the work, is indicative of a keen desire from his part to give Mr. Dobson all possible opportunity of making a complete success of his work.

In the matter of funds, it will be remembered that early in 1911, a subscription campaign was commenced, and a total of nearly $3,000 was subscribed to the movement. This was supplemented in 1912, by a further subscription which brought the amount up to over $1200 a year for three years. For the first year or two after subscriptions were first received no active work had been commenced and for this reason requests for the various payments were not urgent. The result is that there is a considerable amount ofthe 1911 subscription still outstanding, and in numerous cases no payments have been made, although several solicitations have been issued. It is to be hoped that the entire amount will be realised for this work as it was on this assumption that the scholarship movement is being carried out, on such a scale as to maintain a constant bond of interest between the school and its graduates.

ENGINEERING ALUMNI DINNER AT HAILEYBURY

*G. M. SMYTHE, '14.

The third annual dinner of the Timiskaming Branch of the Engineering Alumni Association of the University of Toronto, was held in the Matabanick Hotel, Haileybury, on Friday, Nov. 21. The members of the branch, although scattered over an area covering some hundreds of miles, were nearly all present to do honor to the old school. Dean Galbraith was the guest of honor, and with him at the guests table were Prof. C. H. C. Wright, Prof. J. Watson Bain, Hyndman Irwin (Editor Canadian Engineer), Prof. George A. Guess, H. L. Jones (Mgr. of Buffalo Mines, Cobalt), Mayor M. J. McAuley, of Haileybury, and respresenatives of kindred societies.

Before sitting down to the banquet the lusty lungs of the north, combined to fill the atmosphere with "Toike-Oike" and other ancient war cries, which all goes to show that time and space lessen not the loyalty of a graduate. In fact, if the Haileybury dinner is an indication, these qualities seem to increase with age.

To praise the appointments and the excellency of the dinner itself, would be superfluous. It was hard to imagine that the old red school-house was two hundred miles away, for wherever the eye wandered, it was arrested with "School," "Science," or "Engineering" pennants, and the food—well, let it suffice to say that all noted chefs are not corralled in city service.

Mr. H. W. Sutcliffe, the President of the Timiskaming Branch, gracefully acknowledged the presence of the Dean, and outlined briefly the societies history since its foundation. The first toast of the evening was "Timiskaming—the land of promise." It was proposed by Mr. G. Neilly, who is manager of the Penn-Canadian Mine, and a good, loyal school graduate. Mr. C. H. Fullerton, who has the honor of being the pioneer school man in the district, responded. He touched on the resources of the region apart from the mining industry, and drew attention to the fact that lumbering and agriculture would be very important factors in the near future.

Angus Campbell proposed the "Faculty of Applied Science and Engineering," to which Prof. Bain and Hyndman Irwin responded. This was Prof. Bain's initial experience in the Cobalt region, and he outlined his first impressions of the camp. Our old friend "Mike" Kennedy added an appendix. Mr. Irwin touched on the importance of scholarships, and, by virtue of his close association with the school, gave an excellent account of the work being carried on along that line.

Mayor McAuley, proposed a toast to "the Profession," and Prof. C. H. C. Wright and Prof. Guess responded. Prof. Wright spoke of Timiskaming in the pre-historic days, and also told an original school story in his characteristic style. Prof. Guess received a great welcome as he rose to speak. It was his first appearance in Timiskaming, and the boys disclosed their sentiments regarding our new metallurgical heavyweight in no uncertain manner.

---

* The Engineering Society representative at the Alumni Dinner.

"Mike" Kennedy was in his old time form and contributed much to the entertainment of the evening in his humorous proposal of "Sister Institutions." In response to this, Mr. Frazer Reid, the representative of Queen's graduates, spoke. He was followed by Frank Perry, who waxed warm in proposing the "Ladies," and who stirred up so much enthusiasm that Curtis, Stevens, Titus and many more were brought to their feet in response. The profound knowledge of some men in this regard is appalling.

The Dean received a great ovation when he rose to respond to "Our Guest—the Dean," proposed by E. V. Neelands. He was in rare form, and talked of those things dear to the heart of every school man, be he graduate or student. He reviewed the history of the mining course in the school—its origin and its development, and expressed his pleasure with the success which has attended it. The proof of this success lies in the graduates who have attained such prominence in the mining field.

During the evening telegrams were read from Prof. H. E. T. Haultain, C. H. Mitchell and others who were unable to be present. Mr. W. S. Thorne sang some songs composed for the occasion, and with various other modes of entertainment, contrived to keep the fun going till the wee sma' hours.

We have heard much of late concerning the benefits to be derived from graduate organization, and certainly no one present at the Timiskaming dinner could help being impressed with the truth of this part. If school men in other localities would follow the lead of Timiskaming, what might not be possible?

Mr. Pilley, '11, has an insurance agency at North Bay, Ont.

J. Duthie, '09, is with the Porcupine Crown Mine at Timmins, Ont.

W. A. Spellman, B.A.Sc., '13, is in the roadways department at the City Hall, Toronto.

J. M. Gibson, B.A.Sc., '10, is assistant to Mr. Osborne, streets commissioner, Manning Chambers, Toronto.

J. S. Laing, B.A.Sc., '13, is assistant to the city engineer at Galt, Ont.

E. D. Monk, B.A.Sc., '08, is transformer specialist with the General Electric Co., Cincinnati, Ohio.

R. F. B. Wood, B.A.Sc., '13, is with the firm T. & L. M. Wood, Toronto.

N. L. Crosby, B.A.Sc., '05, is contracting engineer with the Toronto Structural Steel Co. Ltd, Toronto.

Chas. G. Toms, B.A.Sc., '08, is general manager of the Toms Contracting Co. Ltd., Toronto. His address is 56 Spencer Ave., Toronto.

The information re H. O. Merriman, '10, and J. C. Nash, '01, in the directory in October issue is incorrect. Mr. Merriman is first assistant engineer and Mr. Nash is second assistant engineer in the Hamilton Hydro-Electric department.

THE CORROSION OF IRON AND STEEL AND ITS PREVENTION

H. C. Quail, B.A.Sc.

(*Continued from last issue*)

A well known investigator, Friend, has described an experiment which has proved satisfactorily to many that rust cannot form in the presence of water and oxygen without the intervention of carbonic acid. A hollow cylindrical bulb of iron or mild steel, closed in one end, is fitted with a rubber stopper carrying two glass tubes, by means of which a current of cold water can be circulated through the bulb. The outer surface of the bulb having been polished with emery cloth, it is fixed in the upper part of a glass flask containing a fairly strong solution of caustic potash. The pressure of the air in the flask is slightly reduced, after which the flask is hermetically sealed. By shaking the solution, every trace of carbonic acid is removed from the walls of the flask, from the surface of the steel and from the enclosed air. The potassium solution is then heated nearly to boiling point, while a current of cold water is circulated through the bulb; thus, water quite free from carbonic acid is caused to condense on the polished surface and gradually to wash off the potassium solution. Under the conditions of this test, the iron or steel, though wetted with water containing dissolved oxygen, remains bright and unrusted for an indefinite period. Here, again, however, an isolated spot of rust may form, owing to some local impurities in the metal.

Friend endeavors to refute the claim that the surface of the metal is rendered passive by the potassium which is washed over it, by showing that the so-called "passive" state resulting from the action of the alkalies, is not a truly passive state as is that produced by the action of strong nitric and some other acids, which is believed to be due to the formation of a superficial, protective film of oxide. The apparently passive state following the action of the alkalies, is an effect due to the absorption of the alkali by minute pores in the surface of the metal. If this alkali be thoroughly washed out with distilled water, the passivity disappears, and Friend claims that this takes place during his experiment.

However interesting it may be from an academic standpoint, to settle the vexed question whether the presence of an acid is, or is not, essential to the rusting of iron—and its interest is proved when we know that during the past ten years, it has been the subject of experiment by a host of investigators in the United Kingdom, Germany, and America,—the practical importance of the point is largely discounted by the fact that under natural conditions, the acid is always there. All water condensed from the air, whether in the form of rain or dew, besides being saturated with oxygen, contains, in solution, carbonic acid; and, to this must be added, in the neighborhood of towns where coal is burned and where chemical works exist, stronger acids, such as sulphuric, hydrochloric, and nitric acid. These acids commence the attack upon the iron; but it is the oxygen which converts the product into rust: and by removing the dissolved iron from solution, and liberating the acid for a fresh attack upon the metal, it is the most potent agent in promoting corrosion.

5. THE BIOLOGICAL THEORY: Certain bacteria have been found to be the direct cause of corrosion in some few particular cases. The result of investigations, which were made very carefully in each example, showed the importance of facts some of which were previously known in part. There are many kinds of bacteria in whose life-history sulphur plays an essential part. Some reduce oxidized sulphur compounds to hydrogen sulphide; others oxidize the hydrogen sulphide and store up the sulphur; others again, further oxidize the sulphur to sulphuric acid, and produce an acid condition in the soil. In some cases this acid condition can be remedied by proper drainage. Cushman found that the addition of 5% of lime to boggy, sour land exerted a very marked protective influence on iron imbedded in it.

Means of Prevention

Having discussed what is meant by the corrosion of iron and steel and the causes giving rise to it, we must turn now to a consideration of the efforts that have been and are now being made to decrease the tendency towards it or to prevent it entirely.

The means by which the corrosion of iron and steel has been combatted may be classified under two heads, namely:—

(a) The production of the iron in such a form that it may be more resistant to corrosion;

(b) The application of an external coating to the metal.

Of course, the ideal iron would not corrode, but as yet the attainment of that seems to be an impossibility, in spite of the great number of both practical and technical men who have been giving their time with that object in view.

In order to indicate the great scope of the experiments carried on with this ultimate object, I shall outline a few results of the efforts made, by showing the influences of the various impurities in the iron, in regard to the question of corrosion.

One of the chief elements, of which the percentage present in the iron, determines the nature of the final product, is carbon. As a general rule, the results obtained in laboratory tests uncorroborated by experience, are not very satisfactory, especially from the point of view of the practical man:—however, in this case, we are forced to fall back on these in order to gain the desired information, since they only are available. From them, the following general laws may be deduced.

In rolled normalized steel and annealed steels, the corrodibility rises with the carbon content to a maximum at saturation point —(0.89%)—and falls with further increase of carbon beyond that point. In quenched and tempered steels, a continuous rise in corrodibility occurs with an increase of carbon, no corrodibility being found at the saturation point of these steels.

The influence would therefore seem to be that quenching increases the corrodibility to a maximum; annealing tends to reduce it to a minimum; while normalizing gives intermediate values. The effect of tempering is altogether dependent upon the temperature employed.

These results were obtained from work carried out under the auspices of the Research Committee appointed by the British Association to investigate the influence of elements on the corrodibility of iron. In this case, tests were made up to a limit of 0.96% carbon.

In 1905, the Department of Agriculture of the United States of America published a bulletin by A. S. Cushman on the corrosion and durability of fence wire. He drew the conclusion that the presence of manganese in the metal was responsible for the premature rusting, because, as far as he had carried his investigations at the time, he found that the rapidity of the corrosion increased with the amount of contained manganese.

Meantime, the American Rolling Mill Company, Middletown, Ohio, had been at work in an attempt to cut down the manganese content in its low carbon steel. The company had commenced by reducing the amount of manganese thrown into the ladle of its open hearth product, and then gradually cutting that down until none at all was put in. By experience, they proved that the addition of manganese was unnecessary both in the ladle and in the furnace: consequently, it has been eliminated from some of their steels at least.

Again, one of the most injurious impurities in steel is sulphur; and it is also one of the most active in promoting corrosion. In the majority of well made steels, sulphur exists as manganese sulphide, disseminated throughout the metal in the form of more or less minute particles which are readily seen when a polished section is viewed under the microscope. They form active corrosion centres which are not electrolytic, but lead to the formation of sulphuric acid by oxidation, which attacks the iron. That trouble is not so apparent in American steels, since the methods employed tend to reduce the sulphur present and keep it within 0.06 per cent.

Phosphorous does not appear to be objectionable as regards natural corrosion. In point of fact, careful experiments by Diegel as well as the experience of many years with Bessemer and open hearth steels would seem to support the view that phosphorus rather protects the steel to a slight extent.

Oxides and cinder, whether included in the metal or on the surface, are objectionable, being more strongly electro-negative than other foreign matter. As considerable quantities of oxides have to be used in reducing the iron, particularly where very pure iron is desired, the removal of the excess oxides and slag should be carefully looked after. This is a very important point in connection with the general quality and durability of the metal, and requires more vigilance the purer the iron becomes.

It is claimed that the addition of 3½ per cent. nickel will not only protect the iron, but also increase its resistance to corrosion by about twenty per cent.

A recent development which is expected to prove not only of general interest, but also of commercial value, is the statement made by Professor W. H. Walker at a meeting of the American Society for Testing Materials in 1911, in the course of delivering a paper on the subject,—"The Effect of Copper in Iron on Acid Corrosion Tests." The purport of his remarks was that the addition of a very small amount of copper,—about 0.20%,—to open hearth steel, reduces its loss in acid as much as thirty times. These "copper" steels have not been in use long enough to determine their actual value under natural corrosion when in practical use. One fact in their favor, however, is a quality in the copper which makes it easily regulated according to requirements, and, in addition, the copper is readily dissolved in the iron without showing any tendency to segregate. Moreover, the strength of the steel is slightly increased without loss of ductility, and the cost is low in comparison with that of extremely pure iron made either in the open hearth or the electric furnaces.

But, then, leaving out of consideration for the time being the effects of the various elements on the corrodibility of the ordinary commercial steel, the chief object to be attained is uniformity which is the key-note to good practice and is best obtained: by giving special attention to one line of product; by the use of a large mixer; by adopting means for controlling the temperature of the bath in refining and by crushing the ferro-manganese. These are all obvious necessities. The steel should be poured into the ladle as cold as possible and should exhibit a thorough reaction with the additions in the ladle, after which three or four minutes should be allowed for the blanket of slag to take up the oxidized products before teeming into moulds. The uniformity of the steel may be checked easily by comparing the analyses of tests taken from the first ingot with the last few pounds of steel out of the ladle. Such check analyses are made regularly where a specially homogenous metal is desired.

Physical irregularities are just as much to be guarded against as chemical variations of the metal, and require intelligent heat treatment and sufficient work. It has been found that steel which is spongy or honey-combed requires several times as much work to reach its maximum strength as steel which is solid in the ingot.

The most important result coming directly from these continued investigations as to the effects of the various elements present in the steel on its ability to resist corrosion, and, especially following the work done by the American Rolling Mill Company in reducing the amount of manganese used in the production of the metal, has been the establishment of the now accepted facts that the lower the per cent. of impurities present, and the greater the uniformity and homogenity of the metal, the more sustained will be the resistance offered by it to the corrosive action of acids and of natural forces in general.

(To be continued.)

APPLIED SCIENCE

INCORPORATED WITH

Transactions of the University of Toronto Engineering Society

DEVOTED TO THE INTERESTS OF ENGINEERING, ARCHITECTURE
AND APPLIED CHEMISTRY AT THE UNIVERSITY OF TORONTO

Published every month in the year by the University of Toronto Engineering Society

MANAGING BOARD

J. E. Ritchie, B.A.Sc.	Editor-in-Chief.
R. E. Laidlaw, '15	Civil and Arch. Sec.
K. A. Jefferson, '15	Elec. and Mech. Sec.
C. K. Macpherson, '15	Mining and Chem. Sec.
F. C. Mechin, '14	Ex-Officio U.T.E.S.
F. S. Rutherford, '14	Ex-Officio U.T.E.S.

ASSOCIATE EDITORS

H. E. T. Haultain, C.E.	Mining
H. W. Price, B.A.Sc.	Mech. and Elec.
C. R. Young, B.A.Sc.	Civil
J. W. Bain, B.A.Sc.	Chemistry

Treasurer: W. G. Millar, '14

SUBSCRIPTION RATES

Per year, in advance	$2.00
Single copies	.20

Advertising rates on application

Address all communications:

Applied Science,
Engineering Bldg., University of Toronto,
Toronto, Ont.

EDITORIAL

VOLUME VIII. APPLIED SCIENCE

Heretofore each volume of Applied Science has consisted of six issues. Now, that the journal has been increased to twelve issues per year, it has been decided to increase each volume to twelve numbers instead of six, as heretofore. Our readers we believe, will appreciate the advantages to be derived from this change, in view of the fact that twelve numbers can be bound for practically the same cost as could six numbers, and, furthermore, it will be, no doubt, more convenient to have the transactions for the entire year in one bound volume rather than in two volumes. This step, on the part of the Managing Board, accounts for the fact that the index to Volume VIII. did not appear in the October issue. Several inquiries relating to this matter have been received through the mail, and we trust that this explanation will be satisfactory. This issue is consequently Volume VIII. No. 7, instead of Volume IX. No. 1.

J. A. DeCEW, '96 RECEIVES PATENT FOR NEW INVENTION

Judson A. De Cew, B.A.Sc., '96, consulting chemical engineer of Montreal, has just added another rung to the "School's" ladder of fame, by patenting a new invention, relating to a process of recovering escaping acid gases from the sulphite towers used in the manufacture of sulphite liquor for pulp making, which invention will result in marked improvements in wood products. The new invention not only provides a wood product resistant to the attack of ferments, fungi and insects, and renders a soft wood harder and more resistant to mechanical or physical wear, but also reduces the cost of treatments by the well-known processes of wood preservation.

In the new method, the loss of acid gases is overcome by passing the escaping portion through moistened pieces of calcined magnesia and thus recovering them in the form of magnesia sulphite and bisulphite. The sulphite liquor formed by the action of the acid gases on limestone, which is placed in the first chambers of their path may be used to form an emulsion with oil; and if desired, any soluble salt which in itself will not emulsify with oil, may be mixed with oil and waste sulphite liquor to form a perfect emulsion. It will thus be seen that two preserving agents such as oil and a soluble salt may be combined in the form of an emulsion with a third preserving agent, and so the physical difficulties of impregnation by the usual methods be overcome. The organic matter of the waste sulphite liquor when used with any mixture containing creosote or other oil, reduces the rate of evaporation of the lighter oils from the mixture.

Mr. De Cew graduated in mining in 1896, and spent the following four years lumbering in British Columbia, during which time he was a member of the firm, T. N. De Cew & Sons, of Arrowhead.

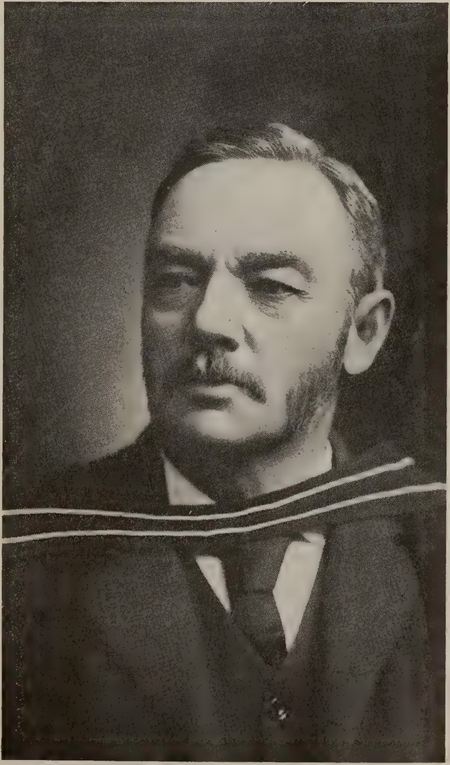
He returned to the "School" in 1900 and took a year in chemical engineering, receiving his degree B.A.Sc., in 1901.

From 1902 until 1905 he was engaged as chemist and chemical engineer by the Canada Paper Co. at Windsor Mills, Que. While there, he had charge of the various processes of manufacture, of all chemical purchases, and of the chemical mill construction. Since that time he has been engaged in consulting work as chemical engineer with his office in the Canadian Express Building, Montreal. His practice has been of an extensive nature, he being engaged in the analysis and testing of paper mill supplies and other materials; in consultation on sulphite and soda pulp processes, the recovery of by-products, ammonia and acid recovery, evaporation, distillation, and the development of processes for the manufacture of chemical materials. He has made a special study of paper, pulp, and wood, and as a result of his careful investigations, he has now received a patent for a new method of rendering wood products more valuable.

Mr. De Cew is an associate member of the Canadian Society of Civil Engineers, he is a charter member of the American Institute of Chemical Engineers, a member of the American Society of Testing Materials, and a member of the Society of Chemical Industry. He has contributed many valuable articles to technical journals and to paper trade journals, and has won for himself a prominent place in the chemical engineering world.

We are indeed pleased to be able to make a most encouraging report with respect to the twenty-fifth annual dinner of the Engineering Society to be held in the Engineering Building on December 5th, at which our Dean will be the central figure and the guest of honor. Since the first announcement of this event in honor of the Dean, letters from graduates have continued to pour in, enthusiastically offering their assistance to render the dinner the greatest possible success. Many graduates in the larger centres have distributed personal letters among the "School" men in their localities so that, if possible, no one might fail to receive proper notice of this opportunity to show the Dean and to show the public that we all appreciate what he has done for his students, for the "School", and for the profession, and that he occupies the warmest corner of every "School" heart.

DINNER TO OUR DEAN



DEAN GALBRAITH

We have endeavored to send announcements of the dinner accompanied by return post cards to all the graduates, but we realize that some will not receive them owing to the fact that we have not their latest addresses. Those who do receive them will not only aid us greatly in preparing for the dinner but will also contribute valued information to our fyles by filling in the blanks and mailing them to us. We appreciate very much any information which we receive concerning our graduates and are indebted to many for their thoughtful assistance in this regard.

Class '08 is holding a re-union during the same week, notice of which has been sent to the members by the class secretary, P. R. Brecken. The occasion of the dinner will serve as an opportunity for ar e-union for practically every class for the various years are vieing with each other in an effort to do themselves honor in honoring Dean Galbraith. Distinguished speakers will be present and a large portion of the evening will be devoted to genuine entertainment, consisting of music, songs, monologues, etc., etc., and other impromptu contributions, the nature of which has not been fully divulged to the editor. There is no doubt but that we will set up a new record both with regard to attendance and with regard to Toike-oike enthusiasm. The old red building will welcome back hundreds of faces to its halls where they once received instruction from their chief adviser and felt the influence of his integrity and personality, which fitted them to go out into the engineering world and be a success. Men will meet who have not met for years and memories of the event will long be cherished in the hearts of those who will be able to be present.

EXCURSIONS

About one hundred and twenty-five "School" men took advantage of the third year annual excursion to Buffalo on Tuesday, November 11th, to visit the Lackawana Steel plant. The party was in charge of T. R. Loudon, lecturer in ferro-metallurgy. The trip was a decided success, the members of the party being given every possible opportunity to acquaint themselves with the various processes in changing the ore to the finished product. The courtesy of the Lackawana Steel Co. is indeed much appreciated by those who reap the benefits to be derived from this annual visit.

On the same day about ninety members of the fourth year journeyed to the Falls to visit the electrical development plants located there. The party was in charge of Prof. Angus.

ENGINEERING SOCIETY MEETINGS

At the first meeting of the society the members were addressed in Convocation Hall on November 15th by Mr. Walter J. Francis, C.E., '93, on "Engineering as a Profession." This paper appeared in the October number of APPLIED SCIENCE. On November 12th a special meeting was addressed by Frank B. Gilbreth, of New York, on "Scientific Management" with special reference to motion study with a view to making the individual more efficient in whatever work he is engaged. By means of stereographic photography the motions of the individual are photographed. A small electric light may be attached to the back of the hand and the path of the light can be photographed, thus giving a visual idea of the motions of the hand in doing a certain work. A series of such photographs taken of the individual who is being instructed, show clearly what progress is being made. Mr. Gilbreth gave many instances of how we in everyday life expend much more energy than is necessary because we do not study our motions and so acquire those which will require the least time and energy.

Sectional meetings were held on October 29th. The civils and architects were treated to a lecture by J. W. Melson, '07, on the

Alaskan boundary survey. The address was illustrated by a large number of slides which gave those present a very vivid conception of the grandeur of Alaskan scenery in the ice mountains and the difficulties which a surveyor encounters in that country. The chemists and miners were addressed by Thomas W. Gibson, deputy minister of mines, on "Characteristic Minerals of Ontario." Mr. C. G. Spencer, mechanical engineer for the Toronto Power Co., addressed the mechanicals and electricals on "Steam Power Stations."

ENGINEERING ALUMNI MEETING

On Monday, November 17, the Engineering Alumni of the University of Toronto held a most successful meeting in the Chemistry and Mining Building at the University at 8 p.m, when about two hundred and twenty-five members enjoyed an exceedingly interesting and instructive lecture given by Mr. S. P. Brown, the managing engineer in charge of the construction of the Mount Royal tunnel at Montreal. Mr. Brown has had a great deal of experience in tunnel work on several large projects, and his extensive knowledge of the work enabled him to make his address very instructive. Numerous slides were shown, illustrating the various problems met with in tunnelling and in subway work, and also the means of overcoming most effectively the difficulties which are encountered. It was a most successful meeting and we hope to see even a greater turn-out at the next.

THE ELECTRIC SHOW

The first electric show in Toronto was held in the Arena Nov. 10 to Nov. 15, and it was a marked success. The exhibition displayed in great variety all kinds of commercial apparatus developed in connection with the use of electricity. Electric motors and methods of making emergency repairs were shown, indicating and recording meters, tungsten lamps, large and small, reflectors and shades of all types for commercial and ornamental illumination, transformers, lightning arresters, switching apparatus, line and interior wiring materials, telephone supplies, a wireless sending and receiving plant in operation, a million volt oscillation transformer, which created noise enough to wake the dead, moving pictures, cow-milking machinery with real live cows to operate upon, electric automobiles, an electrically operated machine shop, electric cooking outfits, with genuine bachelor cooks in competition preparing meals, which they themselves ate with no fatal results, thanks to the excellence of cooking by electricity; in fact, everything profitable and necessary for a enjoyable show.

Lastly, but by no means least, should be mentioned the exhibit of the electrical engineering department of the faculty of applied science and engineering, University of Toronto. The main feature was a special oscillograph which provided for never-failing audiences a programme of voltage and current waves. The series of pictures of occurrences in various alternating circuits, and selectively illuminated signs in explanation thereof, were automatically operated by motor driven devices which performed throughout the show with no failures or other difficulty. The necessary plant operating at the exhibit included two motors, alternator sets, reactors, transformers, electrolytic condensers, rectifiers, and other apparatus. Judging by the continuous attention given this exhibit, it was quite as popular and interesting to the public as the best of the other exhibits.

Another feature of the electrical departments exhibit was an induction motor with special attachments for indicating slip. Above the motor was a card bearing the legend "Watch the slip." So many of the ladies, after watching the motor in silence for several minutes, enquired why that motor did not slip, that it was decided in future exhibits to furnish induction motors, with a properly lubricated toboggan slide, and resulting slip much less visionary then the variety which troubles the electrical fraternity.

CANADIAN CLUB DINNER AT NEW YORK

On Tuesday, November 11th, 1913, the Canadian Club of New York, of which T. Kennard Thomson, '86, is president, held its ninth annual banquet at "The Plaza." Hon. George E. Foster, acting prime minister of Canada, in the absence of Premier Borden, was the guest of honor at the dinner. Other speakers besides Mr. Foster included T. Kennard Thomson, president of the club; ex-congressman Peter A. Porter of Niagara Falls; Andrew B. Humphrey, executive director of the American Peace and Arbitration League; Charles S. Hamlin, assistant secretary of the treasury at Washington; Ernest Thompson Seton, the naturalist and author; Lord Campden, of the British Embassy at Washington; Louis P. Pelletier, the Canadian postmaster-general; John A. Bensel, New York state engineer; Sir George Paish, editor of the London Statist; Dean John Galbraith, of the University of Toronto; J. Emery McLean and W. T. Stevens.

In his opening remarks Dr. Thomson referred to the one hundred year peace celebration next year, and again proposed that in connection with it a great international forest park be formed by the governments of Canada and United States, each buying a strip of land ten miles wide—from Lake Superior to the Pacific Ocean—a park twenty miles wide and fifteen hundred miles long; turning it into a magnificent forest and stocking it with all kinds of animals, birds and fishes. He continued as follows: "I have for years been wondering if there was not some way to check the terrific hot and cold blasts which sweep all the country north of the Gulf of Mexico. Ten days ago the thermometer fell to 30 degrees in Galveston. In Medicine Hat I have seen it stand at 107 degrees in the shade at 5 p.m. (Dominion Day, 1883), and drop to 40 degrees by 6 p.m. In Saskatoon, that wonderful new city of Saskatchewan, one third of June it snowed and early in July it was 107 degrees—and great extremes are experienced all the way down to the Gulf; hence my proposed wind break."

Mr. Humphrey stated that the boundary line between United

States and Canada, unbroken by a single guardian cannon, was the best proof of the peace, founded on real public sentiment and understanding between the two countries. For the coming centennial celebration of peace, he said it was planned to have two bridges thrown across the Niagara River, one-half being constructed by each country, as a permanent memorial of their ancient and abiding friendship. The Hon. George E. Foster made one of the best speeches ever heard in New York, and was ably followed by the other speakers of the evening.

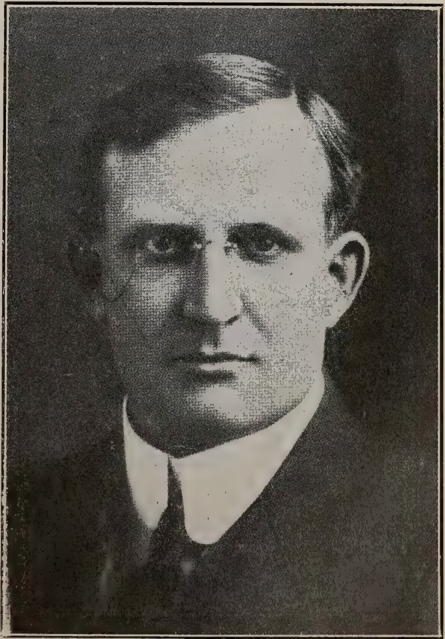
Just as boys in tug-of-war, always put the best man last, so we, for the same reason, refer to our own Dean Galbraith last. He, always a good speaker, spoke at that table of some forty-five guests, who own or control over $2,000,000,000, and in that extraordinary assemblage of powerful men, he certainly had few equals and no superiors in brains, energy, integrity and the love of his fellow-men; and many were the compliments by old friends and also by those who had never heard him before.

So our alma mater was well represented at the most successful banquet ever held by the Canadian Club of New York.

OBITUARY

Russell D. Willson, '01

On Wednesday afternoon, Nov. 17th, Mr. Russell D. Willson, '01, assistant city engineer of Winnipeg, was on a trip of inspection over the city pipe line, six miles north of Winnipeg, when he accidentally touched a live wire carrying 13,000 volts and was electrocuted. It was with much regret that we learned of his sudden demise as he was held in the very highest esteem by his former classmates and by all who knew him, because of his integrity and worthy personality. His first engineering work was in connection with the original surveys of the Toronto-Sudbury line of the C.P.R. This work was done during his "School" course, when he was in the employ of Mr. Hugh D. Lumsden.



RUSSELL D. WILLSON, '01

In 1899 he was in the engineering department of the Canadian Pacific Railway in Toronto under Mr. Hertzberg. In the fall of that year he entered the employ of the Sturgeon Falls Pulp & Paper Co. In 1900 he returned to the "School" and finished his third year, graduating with class '01.

In May, 1901, he severed his connection with Sturgeon Falls Pulp & Paper Co. to accept an offer to go to Winnipeg with the Canadian Northern Railway. When he had been in the Winnipeg office of the Canadian Northern Railway a little over a year, he was placed in charge of that office as assistant to Mr. M. H. McLeod, chief engineer.

In 1906 he left the employ of the Canadian Northern Railway and took a position in the city engineer's office at Winnipeg and was shortly afterwards appointed assistant to City Engineer Col. H. N. Ruttan, which position he held till the time of his death.

G. Galt, B.A.Sc., '07, who has been engaged in mining in the West for the past few years is now mine superintendent of the Cobalt Comet Mines, Cobalt, Ont.

H. G. Kennedy, B.A.Sc., '08, is mining engineer for the Cobalt Lake Mines, Cobalt, Ont.

The firm Sutcliffe & Neelands (both graduates of '07) of New Liskeard, have been awarded the contract for the erection of the large car barns being built by the Nipissing Central Railway Co. at North Cobalt, Ont.

H. E. Cawley, '09, is mining engineer for the Coniagas Mines, Cobalt, Ont.

J. B. Ferguson, B.A.Sc., '09, is on the maintenance-of-way staff in the engineering department of the Canadian Northern Railway at Winnipeg, Man.

K. G. Ross, '06, is associated with the firm Lang & Ross, surveyors and engineers, Sault Ste. Marie, Ont.

G. L. Ramsey, B.A.Sc., '05, has a practice as Ontario land surveyor at Sault Ste. Marie, Ont.

J. M. Riddell, B.A.Sc., '13, who was on survey work for the Indian Reserve department near New Post in James Bay district, during the summer, is now assistant to J. S. Dobie, O.L.S., D.L.S., at Thessalon, Ont.

J. T. Johnston, B.A.Sc., '08, is hydraulic engineer of the water-power branch of the Department of Interior at Ottawa, Can. In the August issue he was listed as assistant engineer, which was incorrect.

H. G. Phillips, '08, is the partner of D. A. Smith, '04, in the firm of Smith & Phillips, Regina, not with Phillips, Stewart & Lee, of Saskatoon, as stated in the directory last month.

R. H. Starr, B.A.Sc., '08, is estimating engineer for the Toronto Hydro-Electric system, Toronto.

B. H. A. Burrows, B.A.Sc., '13, is superintendent of the Coleman Fare Box Co. at their plant at Tottenham, Ont.

Murray D. Kennedy, '08, is manager of the Beacon Consolidated at Elk Lake, Ont.

P (*Continued*)

Pinkney, D. H., '03, is mechanical engineer and chief draftsman in the pipe mill department of the Lorain Works of the National Tube Co. at Lorain, Ohio, U.S.A. His address is 142 Princeton Ave, Elyria, Ohio, U.S.A.

Pivnick, M., '08, has a practice as dental surgeon. We do not know his address.

Playfair, N. L., '92—address not known.

Plunkett, T. H., '03, is a Dominion and Ontario land surveyor at Meaford, Ont.

Ponton, G. M., '09, is consulting engineer at Calgary, Alta. His office is at 513-516 Beveridge Building, Calgary.

Pope, A. S. H., '99—address not known.

Porte, E. H., '11—address not known.

Porte, W. B., '06, has Brown's Corners, Ont., as his home address.

Porter, C. J., '09, is draftsman for Mount Hood Ry. & Power Co. at Portland, Oregon. His address is 95 E. 18th St., Portland.

Potter, R. B., '07, is assistant engineer in the roadways department at the City Hall, Toronto. His address is 235 Garden Ave., Toronto.

Powell, G. G., '02, of 129 Springhurst Ave., is assistant city engineer for Toronto.

Power, G. H., '01, is consulting engineer with Chipman & Power at 47 Canada Life Building, Winnipeg, Man.

Prentice, J. M., '92 (deceased).

Price, H. W., '01, is associate professor of electrical engineering at the University of Toronto.

Pratt, F. M., '11—his address is 343 Nepean St., Ottawa, Ont. He is resident engineer for the E. B. Eddy Co. at Hull, P.Q.

Porchnow, F. E., '07, of 506 Ellicott Square, Buffalo, N.Y., is with Wilhelm, Parker & Ward, patent attorneys, of that city.

Proctor, A. I., '09, lives on King St. E., Hamilton, Ont. We do not know his occupation.

Proctor, E. M., '08, is structural designer in the department of railways and bridges at the City Hall, Toronto.

Procunier, J. F., '07—his home address is Bayham, Ont.

Proudfoot, H. W., '97 (deceased).

Publow, C. F., '08, is electrical superintendent for J. Hutchinson, Gull Lake, Sask.

Pullan, H., '11, is in business with his father at 490 Adelaide St. W., Toronto.

Pullan, E. F., '05, is resident engineer for the Transcontinental Ry. at Cochrane, Ont.

Purser, R. C., '06—his address is 32 Glengarry Ave., Windsor, Ont.

Pye, D. E., '10—his address is Cranbrook, B.C.

Q

Quail, J., '09, is with the Manitoba Bridge and Iron Works.

Quance, G. E., '07, is secretary-treasurer of the Delhi Light & Power Co., Limited, Delhi, Ont.

Quinlan, L. J., '11, is in the topographical surveys branch of the Department of Interior at Ottawa, Can.

R

Raine, H., '07, is with Prack & Perrine, architects and engineers. Hamilton, Ont. His address is 36 Sophia St. S., Hamilton.

Ramsay, W. S., '10—address not known.

Ramsey, G. L., '05, has an Ontario land surveying practice at Sault Ste. Marie, Ont.

Ramsperger, A. F., '09, of 22 Callender St., Toronto, is with the Dominion Bridge Company on the designing staff.

Rannie, J. L., '07, is with the Geodetic Survey branch at the Dominion Observatory, Ottawa, Ont.

Ranson, J. T., '08, of 507 Dundas St., Toronto, has a practice as land surveyor in Toronto.

Ratz, J. E., '11, is with the Geodetic Survey branch of the Department of Interior at the Dominion Observatory, Ottawa.

Ratz., W. F., '02—deceased.

Raymer, A. R., '84, is assistant chief engineer, P. & L. E. Ry., Pittsburg, Pa.

Rayner, G. W., '05. His address is Thorold, Ont.

Raymond, D. L. C., '04, is with the Bishop Construction Co., 614 Traders Bank Building, Toronto.

Read, F. N., '11, is at Kerrobert, Sask.

Redfern, B. J., '10, deceased.

Redfern, W. B., '08, is town engineer at Steelton, Ont.

Redfern, C. R., '09, is engineer for P. Lyall & Sons Construction Co.

Reid, E. V., '11, is with Ross & Macdonald, architects, 1 Belmont St., Montreal.

Reid, F. B., '04, address not known.

Revell, G. E., '99, is engineer with Green Bros. & Burden, at Nelson, B.C.

Richards, E., '99, is Dominion appraiser, in the customs department at Ottawa.

Richardson, F. L., '08, is construction superintendent for Miller, Cumming & Robertson, contractors, 50 Front St. E., Toronto.

Richardson, G. H., '88, is managing director of the Yellowhead Pass Coal & Coke Co. His business address is 24 Credit Foncier Building, Edmonton, Alta.

Richardson, C. W. B., '07, is in the motive power department of the Angus shops at Montreal, P.Q.

Richardson, W. A., '11, is in the employ of Mackenzie, Mann & Co. His address is 47 St. Vincent St., Toronto.

Richardson, W. L., '05. His address is 1316 L Street, Fresno, Cal.

Ricker, H. A., '08, is with the Canadian Westinghouse Co. at Hamilton. His address is 652 Barton St. E., Hamilton, Ont.

Riddell, M. R., '04. His address 86 Spadina Road, Toronto.

Ridler, A. A., '07, is superintendent of the Constructing & Paving Company Limited, Toronto.

Ritchie, H. C., '10, is with the department of Public Works at Calgary, Alta.

Roaf, J. R., '00, is with the Yellowhead Pass Coal & Coke Co. at Bickerdike, Alta.

Robertson, A. R., '08, is sales engineer with McGregor & McIntyre, Toronto.

Robertson, F. A., '08, of 492 Euclid Ave., Toronto, is in the publicity and sales engineering department of the Toronto office of the Canada Cement Co., Limited.

Robertson, H. D., '02, is associated with Miller, Cumming & Robertson, engineers and contractors, 50 Front St. E., Toronto.

Robertson, J., '84, of 531 Palmerston Boulevard, Toronto, is commissioner of The Canada Co.

Robertson, J. M., '93, of 132 Dalhousie St., Montreal, is consulting engineer in that city.

Robertson, N. R., '06. His address is 415 Winch Building, Vancouver, B.C.

Robertson, D. F., '03. Address not known.

Robinson, J., '91, deceased.

Robinson, F. J., '95, is deputy minister of public works at Regina, Sask. His address is 2048 Lorne St., Regina.

Robinson, A. H. A., '97. His last address on our records is 497 Gilmour St., Peterboro, Ont.

Robinson, L. H., '04, is resident engineer for the T. C. Ry. at Superior Junction, Ont.

Robinson, W. A., '08. His address is 259 Young St., Winnipeg, Man.

Robinson, R. C., '08. His address is 173 Yale Ave., Fort Rouge, Winnipeg, Man.

Robinson, W. E., '11. His home address is Beathton, Ont.

Roblin, H. L., '11. His address is Box 921 Cranbrook, B.C.

Roddick, J. O., '06, is assistant engineer in the department of public works of Canada.

Rogers, J., '87, is town engineer at Mitchell, Ont.

Rogers, C. H., '06, is with the Peterboro Canoe Co., Peterboro, Ont.

Rogers, L. J., '08, address not known.

Rolph, H., '94, is secretary to John S. Metcalf Co. Limited, Montreal, Que.

Rolfson, O., '06, is with the Department of Interior at Walkerville, Ont.

Rose, K., '88, is manager of the Evans Rotary Engine Co. of Canada, Curry Building, Toronto.

Rose, R. R., '08. His last address on our records is 59 W. Glasgow St., Guelph, Ont.

Rosebrugh, T. R., '89, is professor of electrical engineering at the University of Toronto, Toronto, Ont.

Ross, J. A., '92, is designer in the engineering office of the L. S. & M. S. railway at Cleveland, Ohio.

Ross, J. E., '88, is on the surveying staff of the Department of Interior at Kamloops, B.C.

Ross, D., '08. Address not known.

Ross, R. A., '90, is consulting electrical and mechanical engineer at 80 St. Francois Xavier St., Montreal, Que.

Ross, K. G., '06, is with Lang & Keys, engineers and surveyors, Sault Ste. Marie, Ont.

Ross, R. B., '05, deceased.

Ross, R. C., '06, his last address on our fyles is 90 St. Francois Xavier St., Montreal, Que.

Ross, O. W., '10, address not known.

Rothery, L. W., '11, his address is 139 Walmer Rd., Toronto.

Rothwell, T. E., '05, is in the provincial assay office at Toronto, Ont.

Rothwell, H. E., '07, is assistant chemist with the Standard Varnish Works at Port Richmond, N.Y.

Rowe, T. L. F., '11. His address is 57 Hallam Ave., Toronto.

Roxburgh, G. S., '04, of 252 Portage Ave., Winnipeg, is manager of Featherstonhaugh & Co., patent solicitors and engineers, Winnipeg, Man.

Rounthwaite, C. H. E., '00, address not known.

Routley, H. T., '06, of 47 Beulamond Ave., Toronto, is a member of the firm Routley & Summers, land surveyors and municipal contractors, of Haileybury, Ont.

Rubidge, W. F. B., '10. His address is Orillia, Ont.

Runciman, A. S., '11, is with the Canadian Westinghouse Co. at Calgary, Alta.

Russell, W. B., '91, has a practice as civil engineer and contractor, 1037 Traders Bank Building, Toronto, Ont.

Russell, R., '93, address not known.

Rust, H. P., '01. His address is 49 Wall St., New York, U.S.A.

Rust, F. C., '11, is with the B.C. Electric Ry. Co., Victoria, B.C. His address is 621 Tenth St., Victoria, B.C.

Rutherford, F. N., '04, is a member of the firm Rutherford & Patten, surveyors and engineers, St. Catharines, Ont.

Rutledge, L. T., '09, is demonstrator in drawing at the University of Toronto.

Rutley, F. G., '11, is engineer on the new plant of the Calgary Power Co. at Kananaskis, Alta.

Ryckman, J. H., '06. His address is 308 Clendennan Ave., Toronto.

S

Satter, E. M., '11, is resident engineer for the C. N. O. Railway at Nipegon, Ont.

Sanders, W. K. D.,' 06, address not known.

Sanderson, A. U., '09, his address is 10 Oaklands Ave., Toronto.

Sara, R. A., '09, is sales manager for the Light and Power Department in the city of Winnipeg, Man.

Sauer, M. V., '01, is mechanical engineer for the Ontario Power Co. at Niagara Falls, Ont.

Saunders, G. A., '99, is on the engineering staff of the Hydro-Electric Commission, Toronto, Ont. His address is 42 Major Street.

Saunders, H. W., '00, is Division engineer for the U. S. Coal and Coke Co., at Gary, W. Va.

Scandrett, F. C., '11, is fellow in surveying, at the University of Toronto.

Scheibe, H. M., '03, is factory manager for E. F. Scheibe, Cambridge, Mass. His address is 10 Bellevue Ave.

Scheibe, R. R., '96, is sales manager for Brigdens Limited, Toronto, Ont. His addeess is 11 Rowanwood Ave., Toronto.

Schlarbaum, A., '09, is with the Riordon Paper and Pulp Co., Merritton, Ont.

Shcofield, C. A., '07, is chemist for the Schoell-Kopf-Hartford and Hanna Co., Buffalo, N.Y. His address is 226 Anderson Place, Buffalo.

Schwenger, C. E., '09, is in the distribution department of the Toronto Hydro Electric System at 276 Yonge Street, Toronto.

Scott, C. A., '09, is assistant engineer in the roadways Department at the City Hall, Toronto. His house address is 96 Glendale Ave.

Scott, G. S., '05, his address is 215 84th Street, Brooklyn, N.Y.

Scott, W. A., '06, is a practicing Dominion and Ontario Land Surveyor at Galt, Ont.

Scott, W. F., '97, is structural engineer at Dunnville, Ont.

Scott, J. W., '11, of 576 Church Street, Toronto, is in the Medical Health Department, Toronto.

Seaton, N. D., '11, of 96 London St., Peterboro, is with the Can. Gen. Electric Co. in that city.

Secord, A. O., '08, is in the contracting business at 8 Temple Building, Brantford.

Sedgewick, A., '09, is assistant provincial highway engineer in the Ontario Department of Public Works. His address is 65 Grosvenor Street, Toronto.

Segre, B. H., '09, his address is 259 Young Street, Winnipeg, Man.

Seibert, F. V., '09, is with the Topographical survey branch of the Department of Interior, at Edmonton, Alta

Serson, H. V., '05, is engineer for Snare & Triest Co., Limited, 143 Liberty Street, New York.

Seymour, H. L., '03, is a member of the firm Sanders and Seymour, civil engineers and Dominion Land Surveyors, Edmonton, Alta.

Shanks, T., '99, is in the Topographical Surveys Branch of the Dept. of Interior, at Ottawa, Ont., as assistant to the Surveyor-General.

Sharpe, N.,' 11, of 68 Walnut Street, Winnipeg, is with Allan Finlay, D.L.S., M.L.S., of that city.

Shaw, J. H., '98, is surveyor and engineer at North Bay, Ont.

Shaw, W. E. V., '08, is assistant engineer in the electrical distribution dept. of the Milwaukee electric Ry. and Light Co., Milwaukee, Wis. His address is 187 12th Street.

Shaw, M. R., '09, address not known.

Shaw, W. C., '10, of 114 Park Road, Toronto, is with the Hamilton Gear and Machine Co.

Sheard, P., '11, is with Geo. W. Gouinlock, architect, Temple Building, Toronto.

Shearer, H. F., '08, is power engineer for the Toronto Hydro Electric System, 226 Yonge Street, Toronto.

Shepley, J. D., '04, is district surveyor and engineer, at North Battleford, Sask.

Sheppard, A. C. T., '07, is with the Department of Interior at Ottawa, Ont.

Shields, J. D., '94, of Hampton Court Apartments, has a private engineering practice in Toronto.

Shipley, A. E., '98, is manager of the Nelson Coke & Gas Co., Nelson, B.C.

Shirriff, C. H., '05, is chemist for the Imperial Extract Co., Toronto.

Sibbett, W. A., '11, is division surveyor for the C.P.R. at North Bay, Ont.

Sills, C. P., '11, is with the Dept. of Interior, Ottawa, Ont.

Silvester, G. E., '91, address not known.

Sinclair, D., '02, deceased.

Sisson, C. E., '05, is with the Canadian General Electric Co. at Peterboro, Ont.

Slater, F. W., '04, is with the General Electric Co. at Schenectady, N.Y.

Smallpiece, F. C., '98, is with the General Supplies Co., Calgary, Alta.

Smart, R. S., '04, is manager of Featherstonhaugh & Co., patent solicitors and engineers, Ottawa, Ont.

Simley, R. W., '97, address not known.

Smith, A. N., '92, is engineer for Wm. B. Pollock & Co., Youngstown, Ohio.

Smith, A., '94, is city engineer, North Vancouver, B.C.

Smith, H. G., '03, deceased.

Smith, Alex. H., '00, is manager of the Teck-Hughes Mine, Swastika, Ont.

Smith, R. W., '98, has a surveying practice at Revelstoke, B.C.

Smith, J. H., '03, address not known.

Smith, D. A., '04, is a member of the firm Smith & Phillips, civil engineers and land surveyors, 1855 Scarth St., Regina.

Smith, K. H., '11, is with the department of Interior at Kamloops, B.C.

Smith, M. L., '11, is laboratory engineer for the Massey-Harris Co., Toronto, Ont.

Smith, W. C., '10, is in the city engineer's office at Victoria, B.C.

Smith, G. E., '10, is on the staff in the department of chemistry at the Montana Agricultural College, Bozennan, Mont.

Smith, F. L., '10, is superintendent of the Queen Victoria Mine, Nelson, B.C.

Smith, F. R., '07, is manager of the Canadian Gowganda Silver Mines, Gowganda, Ont.

Smither, W. J., '04, is demonstrator in drawing at the University of Toronto.

Smithrim, E. R., '07, is superintendent of the Waterous Electric Light, Power & Traction Co. Ltd., Waterous, Sask.

Snaith, W., '07, is secretary-treasurer and manager of the Thor Iron Works, Ltd., Toronto, Ont.

Sneath, R. G., '11, who has been with McArthur, Murphy & Underwood at Melfort, Sask., has returned to Toronto.

Sparling, M. W., '09, is assistant to the general superintendent of the Electric Power Co. at Belleville, Ont.

Speller, F. N., '93, is metallurgical engineer for the National Tube Co., Pittsburg, Penn.

Spence, J. J., '08, is with the Sovereign Construction Co. Ltd., Lumsden Building, Toronto.

Spencer, A. C., '07, is mechanical engineer for the Hamilton Stove & Heater Co., Hamilton, Ont.